

UNITED STATES PATENT APPLICATION

OF

Keon KIM et al

FOR

DRUM ASSEMBLY OF WASHING MACHINE

[0001] This application claims the benefit of Korean Application(s) No. 10-2002-0075002 filed on November 28, 2002, which is/are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

5 Field of the Invention

[0002] The present invention relates to a washing machine, and more particularly, to a drum assembly which provides a big volume as well as reinforces a coupling power to a power transfer element.

Discussion of the Related Art

10 [0003] Generally, a washing machine is an apparatus for eliminating dirt or filth attached to a laundry using reaction between water and detergent.

[0004] Such a washing machine is classified into a pulsator type, an agitator type, and a drum type.

15 [0005] The agitator type washing machine rotates an agitator protruding from a bottom center of a tub in forward and reverse directions to perform washing. The pulsator type washing machine rotates a disc-type pulsator on a bottom of a tub in forward and reverse directions to perform washing using a frictional force between a generated current and a laundry. And, the drum type washing machine rotates a drum holding water, detergent, and laundry at low speed to perform washing. In this case, a plurality of tumbling ribs protrude
20 from an inside of the tub.

[0006] Meanwhile, in case of the drum type washing machine, a power of a motor is indirectly transferred to the drum. For instance, the drum is connected to a driving shaft rotated by the motor via a belt or a complicated gear or clutch assembly.

[0007] However, a size of a cabinet is sufficiently large or a volume of the drum is

reduced since various kinds of parts for rotating the drum should be installed in the cabinet.

[0008] Moreover, a coupling power between the drum and the power transfer elements is relatively weak, whereby the washing machine is out of order or power transfer fails to be performed well.

5

SUMMARY OF THE INVENTION

[0009] Accordingly, the present invention is directed to a drum assembly that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

10

[0010] An object of the present invention, which has been devised to solve the foregoing problem, lies in providing a drum assembly, by which a big volume cab be designed sufficiently large.

[0011] It is another object of the present invention to provide a drum assembly, which provides a big volume as well as reinforces a coupling power to a power transfer element.

15

[0012] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent to those having ordinary skill in the art upon examination of the following or may be learned from a practice of the invention. The objectives and other advantages of the invention will be realized and attained by the subject matter particularly pointed out in the specification and claims hereof as well as in the appended drawings.

20

[0013] To achieve these objects and other advantages in accordance with the present invention, as embodied and broadly described herein, there is provided a drum of a washing machine including an opening confronting a door, a rear wall provided opposite to the opening, the rear wall having a circumferential portion protruding more outward than a

central portion, and a circumferential wall between the opening and the rear wall.

[0014] In another aspect of the present invention, there is provided a drum assembly of a washing machine including a drum including a rear wall having a circumferential portion protruding more outward than a central portion, a spider attached to an outside of the rear wall,
5 and a driving shaft connected to the spider.

[0015] In another aspect of the present invention, there is provided a washing machine including a cabinet, a tub in the cabinet, a drum including a rear wall having a circumferential portion protruding more outward than a central portion, a spider attached to an outside of the rear wall, a driving shaft connected to the spider, and a motor provided in the
10 cabinet to be connected to the driving shaft.

[0016] In the present invention, the circumferential portion and the central portion are preferably connected to be slant. Preferably, the rear wall is uniform in thickness to enhance an inner space of the drum.

[0017] Meanwhile, the spider is preferably attached closely to the outside of the rear
15 wall. And, an edge part of the spider coupled with the circumferential portion of the rear wall is preferably thinner than a central part of the spider connected to the driving shaft. Moreover, a circumferential part of a rear side of the tub protrudes more outward than a central part of the rear side of the tub penetrated by the driving shaft.

[0018] It is to be understood that both the foregoing explanation and the following
20 detailed description of the present invention are exemplary and illustrative and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The accompanying drawings, which are included to provide a further

understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0020] FIG. 1 is a cross-sectional view of a washing machine according to a first
5 embodiment of the present invention; and

[0021] FIG. 2 is a cross-sectional view of a washing machine according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

10 [0022] Reference will now be made in detail to the preferred embodiment(s) of the present invention, examples of which are illustrated in the accompanying drawings. Throughout the drawings, like elements are indicated using the same or similar reference designations where possible.

[0023] FIG. 1 is a cross-sectional view of a washing machine according to a first
15 embodiment of the present invention. A construction of a washing machine according to a first embodiment of the present invention is explained by referring to FIG. 1 as follows.

[0024] Referring to FIG. 1, a tub 10 is provided in a cabinet 1. The tub 10 is cylindrical and is made of a stainless steel based material. The tub 10 is suspended in the cabinet 1, for which a plurality of springs 2 and dampers 3 are provided between the tub 10
20 and the cabinet 1. The provided springs 2 and dampers 3 plays a role in suspending the tub 10 in the cabinet 1 as well as in attenuating vibrations of the tub 10 while a washing machine operates.

[0025] A door 4 is provided on a front side of the cabinet 1. And, a gasket 8 is provided between the tub 10 and the door 4 to prevent water leakage. Water supply and drain

equipments 5 and 6 are provided in the cabinet 1. The water supply equipment 5 supplies water from outside to the tub 10, and the drain equipment 6 discharges the water of the tub 10 outside. Meanwhile, a non-explained numeral '7' indicates a control panel for controlling the washing machine.

5 **[0026]** And, a drum 20 is provided in the tub 10. The drum 20 includes an opening 21 at a front side, a rear wall 22 in an opposite side to the opening 21, and a circumferential wall provided between the opening 21 and the rear wall 22.

[0027] In this case, the rear wall 22 lies parallel with a rear side of the cabinet 1. And, a multitude of apertures (not shown in the drawing) are formed in the circumferential wall 23.
10 Hence, the water supplied to the tub 10 flows in the drum 20 via the apertures.

[0028] A plurality of tumbling ribs 14 are provided on an inside of the circumferential wall 23. When the drum 20 rotates, the laundry held in the drum 20 is lifted up by the tumbling ribs to fall down, by which frictional and shock energy for washing is sufficiently provided.

15 **[0029]** A spider 30 is attached to an outside of the rear wall 22 of the drum 20. The spider 30 includes a multitude of legs extending radially from a central portion. The legs increases a coupling power between the spider 30 and the drum 20. Such legs are arranged by 120° for example.

[0030] A driving shaft 15 is connected to the spider 30, for which the driving shaft 15
20 is installed to penetrate into the tub 10. A boss 31 protruding outside is provided at the central portion of the spider 30 coupled with the driving shaft 15. And, a motor 40 is provided in rear of the tub 10 inside the cabinet 1 to rotate the driving shaft 15.

[0031] The motor 40 includes a rotor 42 and a stator 41. For example, in an outer rotor type motor 40, as shown in FIG. 1, the rotor 42 encloses the stator 41. Referring to Fig.

1, the driving shaft 15 is connected to the rotor 42. And, the stator 41 is coupled to be fixed to the rear wall of the tub 10. Once power is applied to the motor 40, the rotor 42 starts to rotate together with the driving shaft 15 so as to rotate the drum 20.

[0032] Meanwhile, front and rear bearings 41 and 17 are provided to the driving shaft
5 15. The front bearing 41 lies between the rear wall of the tub 10 and the driving shaft 15. And, the rear bearing 17 lies between the driving shaft 15 and the stator 41 of the motor 40. Hence, even if the tub and stator 10 and 41 are fixed, the driving shaft 15 penetrating the tub and stator 10 and 41 enables to rotate. Besides, a non-explained numeral '18' in FIG. 1 indicates a bearing housing.

10 [0033] An operation of the above-constructed washing machine according to the first embodiment of the present invention is explained as follows.

[0034] First of all, a user puts a laundry in the drum 20, closes the door 4, and then manipulates the control panel 7. The water supply equipment 5 then supplies water and detergent to the drum 20 appropriately.

15 [0035] After completion of water supply, power is applied to the motor 40 to rotate the rotor 42 and the driving shaft 15. A rotational force of the driving shaft 15 is transferred to the spider 30 so that the drum 20 is rotated together with the spider 30. Once the drum 20 rotates, the laundry is repeatedly lifted up by the tumbling ribs 14 and to fall for washing.

[0036] After completion of washing, the drain equipment 6 discharges the used water
20 of the drum and tub 20 and 10 outside. After completion of draining, the water supply equipment 5 supplies the drum 20 with water, the drum 20 then rotates to rinse the laundry. The drain equipment 6 then discharges the water used for rinsing outside. Such a rinsing step is performed at least once.

[0037] After completion of rinsing, the drum 20 rotate at high speed. A centrifugal

force separates water contents from the laundry. After completion of dewatering, the user pulls out the washed and dewatered laundry via the door 4.

[0038] Moreover, if the washing machine is equipped with a drying function, hot air is supplied to the drum 20 to completely dry the laundry. The user then attains the completely washed and dried laundry.

[0039] Meanwhile, during the washing, rinsing, dewatering, and so on, massive vibrations are applied to the tub 10. The vibrations applied to the tub 10 are attenuated by the springs 2 and dampers 3 so as not to be externally transferred.

[0040] In the above-described washing machine according to the first embodiment of the present invention, the motor 40 is directly connected to the driving shaft 15 penetrating the tub 10. Hence, a space for installing the parts for rotating the drum 20, i.e., a space between an inside of the cabinet 1 and an outside of the tub 10 can be reduced. Accordingly, the washing machine according to the first embodiment of the present invention enables to design a smaller cabinet 1 or an enhanced volume of the drum 20.

[0041] Despite such an advantage, the washing machine according to the first embodiment of the present invention has the following disadvantages.

[0042] First of all, a space is provided between the rear wall of the tub 10 and the rear wall 22 of the drum 20. Yet, in the washing machine according to the first embodiment of the present invention, the rear wall 22 of the drum 20 lies parallel with the front and rear sides of the cabinet 1 and the boss 31 protrudes from the center of the spider 30 coupled with the driving shaft 15. Hence, the washing machine according to the first embodiment of the present invention fails to utilize the space between the rear wall of the tub 10 and the rear wall 22 of the drum 20, thereby having a limitation in increasing the volume of the drum 20.

[0043] Secondly, in the washing machine according to the first embodiment of the

present invention, a contact area between the rear wall of the drum 20 and the spider 30 is small, whereby a coupling strength between the drum 20 and the spider 30 is vulnerable.

[0044] Therefore, the present invention provides a second embodiment overcoming the disadvantage of the first embodiment. A second embodiment according to the present invention provides a modified drum, which is explained in detail by referring to FIG. 2 as follows. FIG. 2 is a cross-sectional view of a washing machine according to a second embodiment of the present invention. In describing a second embodiment of the present invention, like elements are skipped but uniqueness of the second embodiment is explained.

[0045] Referring to FIG. 2, a drum 200 includes an opening 210, a circumferential wall 230, and a rear wall 220. Since the opening 210 and circumferential wall 230 are the same of the first embodiment of the present invention, a structure of the rear wall 200 is explained only in the following.

[0046] The rear wall 220, as shown in FIG. 2, includes a circumferential portion 225 and a central portion 221, in which the circumferential portion 225 protrudes more outward than the central portion 221. In other words, in viewing the tub 10 from a rear side, the central portion 221 is concave toward the opening 210.

[0047] In this case, a distance between the opening 210 and the circumferential portion 225 is greater than that between the opening 21 and rear wall 22 of the drum 20 shown in FIG. 1. And, a distance between the opening 210 and the central portion 221 is equal to or greater than that between the opening 21 and rear wall 22 of the drum 20 shown in FIG. 1. Hence, the drum 200 of the second embodiment of the present invention has a volume greater than that of the drum 20 of the first embodiment of the present invention.

[0048] Meanwhile, the rear wall 220, as shown in FIG. 2, is preferably uniform in thickness, which is for substantially expanding an inner space of the drum 200 as the

circumferential portion 225 protrudes.

[0049] Moreover, a rear wall of the tub 10, as shown in FIG. 2, preferably has its circumferential area protrude more outward than its central area into which the driving shaft penetrates. So, the circumferential portion of the rear wall of the drum 200 can protrude more
5 so that the overall volume of the drum 200 can be increased.

[0050] Besides, in the washing machine according to the second embodiment of the present invention, the spider 300, as shown in FIG. 2, is attached to an outside of the rear wall 220 of the drum 200. A boss 315 is provided at a central part 310 of the spider 300, and the driving shaft 315 is fitted to the boss 315.

10 [0051] An edge part 320 of the spider 300, as shown in FIG. 2, is formed thinner than the central part 310 coupled with the driving shaft 15. Namely, the central part 310 is thicker than the edge part 320.

[0052] With the above-construction of the spider 300, a space between the rear wall of the tub 10 and the spider 300 can be reduced so that the volume of the drum 200 can be
15 increased. Namely, in the washing machine according to the second embodiment of the present invention, the circumferential portion 225 of the rear wall 220 of the drum 200 protrudes outward to decrease the space between the rear wall of the tub 10 and the spider 300. Yet, if the edge part 320 of the spider 300 is formed thick, a height available for the circumferential portion 225 to protrude is reduced so that the volume of the drum 200 is
20 unable to be sufficiently increased. Hence, in the washing machine according to the second embodiment of the present invention, the edge part 320 of the spider 300 is formed thin to increase the height available for the circumferential portion 225 to protrude. Thus, the volume of the drum 200 increases in proportion to the height enabling the circumferential portion 225 to protrude. Besides, the edge part 320 of the spider 300, which undergoes no severe force

applied thereto, is formed thin, thereby having no influence on the rigidity of the spider 300.

[0053] Moreover, with the above-explained construction of the spider 300, a portion connected to the driving shaft 15 is formed thick to increase a coupling strength with the driving shaft 15 as well. Hence, despite long time use, there takes place no breakdown or failure of power transmission.

[0054] Meanwhile, in the washing machine according to the second embodiment of the present invention, the circumferential portion 225 and central portion 221 of the rear wall 220 of the drum 200 are preferably formed slant to each other. And, the spider 300, as shown in FIG. 2, is preferably brought tight contact with the outside of the rear wall 220. With such a construction, a contact area between the rear wall 220 and the spider 300 increases, whereby a stress applied to the rear wall 220 and spider 300 can be reduced for providing a more stable structure.

[0055] The washing machine according to the second embodiment of the present invention operates in the same manner of the washing machine according to the first embodiment of the present invention. Yet, they just differ in that the second embodiment washing machine can hold more laundry than the first embodiment washing machine because of the increased volume of the drum 200. Moreover, the drum 200, spider 300, and driving shaft 15 are coupled more securely in the washing machine according to the second embodiment of the present invention, whereby there takes place less breakdown or failure of power transmission.

[0056] Accordingly, the washing machine according to the present invention has the following advantages or effects.

[0057] First of all, a space for installing parts for rotating the drum, i.e., a space between the inside of the cabinet and the outside of the tub can be reduced, whereby the

cabinet can be designed small or the volume of the drum can be designed large.

[0058] Secondly, the circumferential portion of the rear wall of the drum protrudes more outward than the central portion thereof. And, the edge part of the spider is formed thinner than the central part thereof. Hence, the space between the spider and the rear wall of the tub can be reduced. Therefore, the volume of the drum can be increased.

[0059] Thirdly, since the rear wall of the drum is curved, the contact area between the spider and the rear wall of the drum increases. Therefore, the coupling strength between the drum and the rotational shaft can be improved and breakdown and power transmission loss can be reduced.

[0060] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover such modifications and variations, provided they come within the scope of the appended claims and their equivalents.